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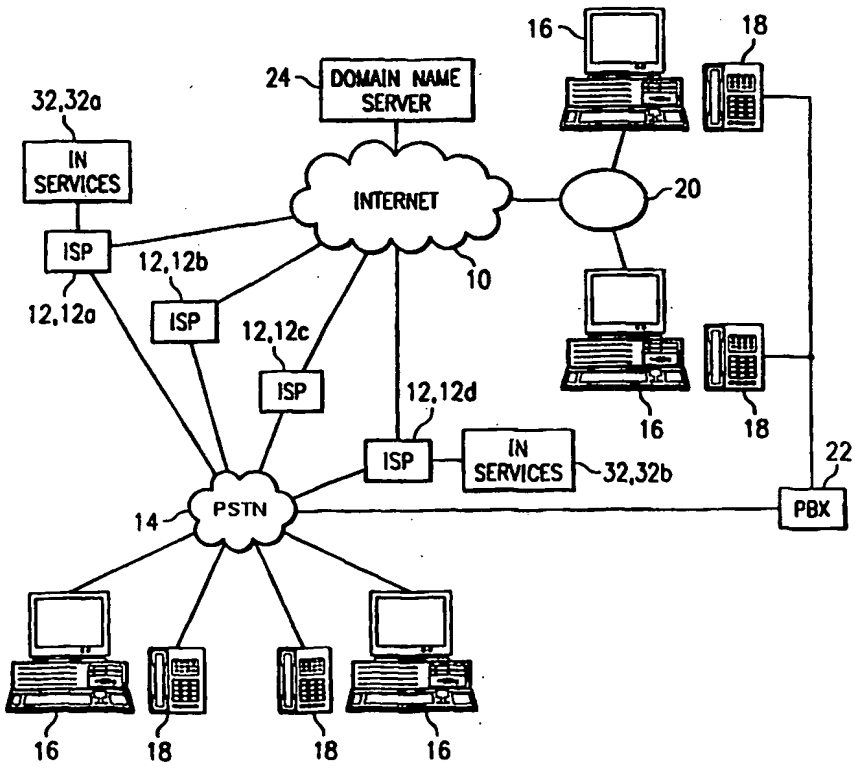
(54) Title: METHOD AND APPARATUS FOR DYNAMIC DOMAIN NAMES

(57) Abstract

A system of connecting to the Internet (10) is provided, where logical addresses are dynamically associated with physical IP addresses, depending upon the value of parameters, such as time of day, day of week, load, and user profile information. Upon receiving a domain name (logical address), IN Services (32) can determine a physical address through which a connection with a web browser or a digital/wireline/wireless connection can be made. A dynamic ILS (64) is provided to dynamically route telephone calls over the Internet (10), or other data network, or PSTN (14), including wireline and wireless calls, based on one or more parameters.



METHOD AND APPARATUS FOR DYNAMIC DOMAIN NAMES

BACKGROUND OF THE INVENTION

1. TECHNICAL FIELD

This invention relates in general to Internet communications and, more particularly, to a method and apparatus for providing dynamic domain names.

2. DESCRIPTION OF THE RELATED ART

Over the last several years, the Internet has enjoyed unprecedented success, both as a means to distribute information globally and as a means for communicating between a set group. The importance of the Internet spans educational, commercial and government sectors.

The primary tool for addressing a site on the Internet is through domain names. Domain name registration is currently regulated through an independent entity, InterNic. For example, the domain name "www.fredspizza.com" could be registered with InterNic for use with a pizza parlor's web site. After the domain name is registered, it is associated with a physical address (IP address) of the Internet site at a domain name server. When a user enters a domain name to reach an Internet site, the IP address associated with the domain name is retrieved. The user also has an IP address; this address may be a permanently assigned IP address, or it may be allocated dynamically by the user's ISP when the user logs on to the Internet. The IP

BRIEF SUMMARY OF THE INVENTION

In the present invention, network services are provided wherein a logical address is received from a user at an network access provider. Database circuitry determines a physical address associated with the logical address, where said logical address can be associated with more than one physical address, based on one or more current parameters.

The present invention provides significant advantages over the prior art. First, an ISP can set certain domain names to be dynamic, i.e., capable of pointing to any one of a plurality of IP addresses depending upon one or more parameters, such as time of day, user telephone number, user address, and other user profile information. The ISP can sell the services to companies which need the flexibility of directing a domain name to a site depending upon the current values of certain parameters. The mapping is transparent to the ISP's users. For use in an ILS, users can set restraints on the dates and times that they can be called, by whom they can be called, on what devices they can be reached, or on other conditions or combinations of conditions.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is best understood in relation to Figures 1 - 10 of the drawings, like numerals being used for like elements of the various drawings.

Figure 1 illustrates a block diagram showing connections to the Internet (or other public network) in a simplified form. The Internet 10 is similar to a giant local area network (LAN), allowing different users to communicate with each other. There are various ways to connect with the Internet. Many users connect to the Internet via an Internet Service Provider (ISP) 12. ISPs can be local to a community or can be large nationwide services, such as America On Line (AOL), which has points of presence (POPs) throughout the world. Typically users connect to the ISPs 12 through the public switched telephone network (PSTN) 14, which is connected to both their computers 16 and phones 18. In some cases, users may connect to an ISP using lines outside of the PSTN.

Larger companies may have a direct Internet connection. In this case, the company owns the equipment to make the connection to the Internet and shares the equipment with its internal users. Rather than connect through the PSTN 14, users connect to the Internet through the company's LAN 20. Phone service, however, is generally made through the PSTN 14, normally via a private branch exchange (PBX) 22.

Unlike the PSTN, which is a circuit-switched system, the Internet is a packet-switched system. Data is sent in packets, each packet having a destination address. Currently, physical Internet addresses, also known as an IP (Internet Protocol) addresses, consist of four numbers (each of which can be represent by a byte), separated by periods. An example of a physical Internet address is "255.5.234.81." Routers (see Figure 2a) receive data packets and pass the packet along in accordance with the IP address associated with the packet. Routers use routing algorithms,

and others typically have thousands of sub-domains. The DSC sub-domain is shown with a SPD sub-domain.

If a host "sun100" within the SPD sub-domain of DSC ("sun100.spd.dsc.com") wanted to connect to a host named sun500 in the PURDUE sub-domain ("sun500.purdue.edu"), the browser would initiate a search through the name server for the SPD domain. The name server for the SPD domain would query one of the root name servers for the address of sun500.purdue.edu. The root domain is not responsible for that host, but it does know the address for the EDU domain name servers. It thus returns the IP address of the EDU name server to the querying SPD name server. The SPD name server then queries the EDU name server, which, similarly, responds with the address of the PURDUE name server. When the SPD server queries the PURDUE name server, which knows the address of the sun500.purdue.edu host, the PURDUE name server returns the IP address to the SPD server, which passes the address to the user's browser software for further communications between the two hosts.

It should be noted that a name server is not a router. A name server is a program that stores data about a zone, which can either be a single domain or include sub-domains. It provides the information to translate between domain names and addresses. A router is merely a means of interface between different name servers and different networks. The routers analyze the destination address and determine the best way to get there through the network. Name servers know which specific host they want to connect to by knowing its IP address and the router determines the best path to communicate between the two hosts.

A "resolver" is a program that utilizes the name servers. Resolvers receive a user's request (a logical host name) and formulate a query to a name server. The query they send to a name server is called a "recursive" query, which transfers control of the host name resolution to the name server. Once the name server has translated the resolver's query into an address (or name), the resolver must interpret

```
;addresses
nameserver.dsc.com          IN A        101.36.2.68
host1.dsc.com               IN A        101.36.2.115
host2.dsc.com               IN A        101.36.2.5
nameserver.dsc.com          IN A        101.36.4.88

;Aliases
www.dsc.com                 IN CNAME    nameserver.dsc.com
```

The zone file set forth above is a typical example of a BIND 8.1 zone file. The first line of information defines the zone or default domain properties. After this Start of Authority ("SOA" record) information, the domains are defined and linked (by a type NS record) to a name server. After that, all hosts in the primary domain (indicated by the first line), including the name server host, are listed and liked (by a type "A" record) with their corresponding IP address.

The SOA filed lists mostly information for a secondary name server. However, the Time To Live (TTL) field is for all data. It tells the querying name server how long to keep the information in its cache before deleting it (thus forcing the name server to repeat the query process on the next occasion where the host is requested).

The zone files are loaded into the computer's memory when the name server daemon is started. Accordingly, the zone files are only read upon startup, and changes to the file require the name server daemon to be restarted. Zone files change only rarely, so this is not normally a problem. A zone file will change if a host name changes, if the host name's corresponding IP address changed, or if another host was added to or deleted from the name server's domain.

Once the zone files are loaded into memory, the name server is ready to respond to queries. The most common query is an address query, such as request to the DSC name server for www.dsc.com. According to the zone file above, it would bind this address as a type "CNAME". The name server then sees the alias for

connections could be used in a number of commercial settings, such as on-line catalog services, where the customer may need to talk to a representative. The IN Services 32 could direct a digital phone connection to one of a number of available service representatives at various locations. The digital phone connection could be based on time of day, current load, or other parameters, such as the user's ISP or local exchange carrier. This would allow a representative to work out of various locations, including for example, his or her house, with the IN Services directing the digital phone connections to the proper site. An ILS service is discusses in greater detail in connection with Figure 7-10 below.

Another parameter which could be used processing IP addresses is the location of the requesting user. The IN Services could look up the address of a requesting user and connect the user to specific home page or digital phone based on the address. For example, if the user entered "www.pizza.com", the IN Services 32 would access its database of users and find the address of the user, then use that address to find the location of the nearest pizza vendor who had contracted with the ISP.

Other parameters which may be used to determine an IP address from a domain name include day of week, the user's telephone number, and other user profile information, such as age, gender, income and so on. Multiple parameters may be used in determining the IP address associated with a dynamic domain name.

Figure 4 illustrates a more detailed block diagram of one embodiment of the IP Services 32. The IP Services include a domain name server 40 and a service control point (SCP) 42. The SCP 42 may be of the type normally used in telecommunications. The SCP 42 is coupled to a SLEE (service logic execution environment), to an SCE (service creation environment) and to an SMS (system management system).

In operation, when a subscriber to the ISP enters a domain name which is directed to a site which in the zone of the domain name server 40, the domain name

host2.dsc.com	IN A	101.36.2.5
nameserver.dsc.com	IN A	101.36.4.88
support.dsc.com	IN DYN	101.101.101.101
;Aliases		
www.dsc.com	IN CNAME	nameserver.dsc.com

When a query is sent to the name server 40 requesting translation on support.dsc.com, the name server 40 would find the entry of type "DYN" and initiate a pre-designated service using the SLEE 43 and SCP 42. The 101.101.101.101 is a dummy IP address and would not be returned to the requesting name server. The name server 40 would listen to a preset port for an answer from the SLEE 43 and SCP 42. The name server 40 would receive an IP address, which it would return as a response to the requesting name server. With a dynamic domain name request, the name server 40 would return a time to live of "0" in order to prevent associations between dynamic domain names and IP addresses from being cached.

An advantage of the dynamic DNS name server 40 described above is its ability to interface to both a SLEE and the Internet. Any service that can be created on an execution environment can apply its logic to Internet based calls or queries. For example, the SLEE 43 may be programmed to direct queries to support.dsc.com to a different web site, depending upon any number of criteria, such as the current load on the various web servers, the time or day, or customer information. From the information available at the time of the request, the SLEE could determine which web server should receive the connection, and return that IP address to the requesting party.

The creation of services on the SCP 42 can be made using service creation environment (SCE), of the type used in the telecommunications field. A description of the interaction between the SCE and the SCP 42 is described in *World Wide Web*

digital phone software to voice signals sent to the calling party. The PSTN, in the preferred embodiment, will translate the voice signals at a router location physically near the user to maximize audio quality. Connections between the Internet, or other network, and the PSTN are also discussed in connection with U.S. Ser. No. 60/089,021, entitled "Programmable Telecommunications Interface", to Lee, Jr. et al, filed June 12, 1998 and U.S. Ser. No. 60/096,512, filed August 14, 1998, entitled "Programmable Telecommunications Interface" to Lee, Jr. et al, both of which are incorporated by reference herein.

Similarly, a call originating at a digital phone could connect through the PSTN to another user's telephone. In this scenario, if the digital phone could not make a connection through the Internet (for example, if the called party was not currently connected to the Internet), the digital phone could pass the voice data packets to a router, preferably located proximate the called party (the user could supply the telephone number). Data packets from the calling party would be translated into voice signals and voice signals from the called party would be translated to voice data packets via a converter 46 associated with the selected router. The SCP 42 could maintain a list of IP addresses associated with various area codes to direct the packets to the proper router.

This embodiment of the invention provides significant advantages to Internet users who share a telephone line between a modem and a telephone. In this embodiment, phone calls can be originated and received through the PSTN during an Internet session.

Figure 6 illustrates a third embodiment where user connections to an ISP can take place apart from the PSTN. In this embodiment, users of an ISP have phones 18 and computers 16 connected to the ISP through an ATM multiplexer 48 and an ATM switch. ATM switch is also coupled to the PSTN 14 and to other ATM switches. Although Figure 6 illustrates a single ATM multiplexer 48 and ATM switch 50, in

ILS is shown in Figure 8. A user selects a logical address (a name or an e-mail address) from the list and presses "Call" to make a connection to a physical address associated with the logical address.

While, in theory, a user could maintain a list of IP addresses to which digital calls are made, in practice, many users who connect through an ISP have dynamic IP addresses; i.e., the ISP has a set number of IP addresses which it assigns randomly to subscribers as they log in. Once the subscriber terminates the session, the association between the subscriber and the IP address is broken. Thus, in order to determine an address for a person with a dynamic IP address, ILS services are needed.

Referring again to Figure 7, a requesting digital phone 60 is attempting to make a connection to the destination digital phone 62 through the Internet. The dynamic ILS 64 can determine an IP address based on a number of factors, similar to those discussed in connection with the dynamic DNS system above. Hence, when a user selects a name from an ILS list and presses "Call", the dynamic ILS determines the physical address of the receiving party based on one or more parameters. For example, a user may only want to receive calls during certain hours of the day. Further, the user may only want to receive calls from certain people during those hours. The dynamic ILS is optionally coupled to the PSTN (wireline) and mobile (wireless) phone systems as well to provide enhanced features discussed below.

In another service, a user may want to receive calls through the Internet first (during working hours), through the PSTN second, through a mobile phone third and through voice mail fourth. Thus, if a requesting digital phone made a request for an address to this user, the dynamic ILS 64 would first determine whether the user was currently logged in, i.e., whether the user currently was running his or her digital telephony program. If the user was available (and assuming the calling party met other criteria selected by the destination user) the dynamic ILS would send the IP address of the destination user to the requesting user. In this scenario, even if the destination user was not available on the Internet, his or her name would be shown

a number of criteria, such as time of day. A VPN uses a public network, such as the Internet or other IP backbone, in place of dedicated WAN (wide area network) links. A VPN can decrease costs and increase functionality over normal WAN structures. A problem in VPN and other network structures, is that the mobility of a user is somewhat constrained. This is a particular problem for portable computer users, who would like to be able to connect to different network ports. Using the dynamic ILS, a user could log into the ILS when, for example, he or she was using a connection in a conference room. The ILS could perform a mapping of the user's normal IP address to the IP address of the conference room port, so that the user could receive digital telephone calls, e-mail, and so on, at the new port.

Figure 9 illustrates a basic block diagram of a dynamic ILS 64. A SLEE 66 is coupled to an LDAP server 68 and to a database 70. The LDAP server 68 receives LDAP (lightweight directory access protocol) requests, which are used to initiate a service using the SLEE 66 and database 68. The SLEE 66 and database 70 make decisions on what IP address is returned based on criteria defined by a service, such as those criteria discussed above. The SLEE 66 and database 70 could also function as an SCP, HLR and/or DNS.

Figure 10 illustrates a flow diagram for the dynamic ILS 64. In block 80, an ILS is received in LDAP, or another suitable protocol. The request could be a user status request (log in, log out or change user profile) a destination status request. If, in block 82, the LDAP request is user status request, the database 70 is updated accordingly in block 84. A user status request could involve, for example, a login to set flags in the database indicating that the user was available to receive calls (under certain criteria), or status change request to change criteria (for example, the people allowed to contact the user or the hours in which calls would be received) or a logout to set flags in the database that the user was not receiving calls.

The criteria which may be used with a given service is virtually unlimited. The criteria for a individual could be based on any combination of time of day, day of

CLAIMS

1. Circuitry for providing public network services, comprising:

circuitry for receiving a logical address from a user at a network access provider;

database circuitry for determining a physical address associated with said logical address, where said logical address can be associated with more than one physical address, based on one or more current parameters.

2. The circuitry of claim 1 wherein one of said parameters comprises a time of day parameter.

3. The circuitry of claim 1 wherein one of said parameters comprises a day of week parameter.

4. The circuitry of claim 1 wherein one of said parameters comprises a load parameter.

5. The circuitry of claim 1 wherein one of said parameters comprises a location associated with the user.

6. The circuitry of claim 1 wherein one of said parameters comprises a telephone number associated with the user.

7. The circuitry of claim 1 wherein one of said parameters comprises a profile information associated with the user.

8. The circuitry of claim 1 said database circuitry comprises a service control point.

9. The circuitry of claim 1 wherein said physical address comprises a physical address associated with a digital phone for audio communication through the global network.

18. The method of claim 11 wherein said determining step comprises the step of determining the physical address based using a service control point.

19. The method of claim 11 wherein said determining step comprises the step of determining a physical address associated with a digital phone for audio communication through the global network.

20. The method of claim 19 wherein said determining step comprises the step of determining the physical address based at least partially on a location of an operator associated with said digital phone.

21. Circuitry for providing telephony locator services, comprising:

circuitry for receiving a request from a calling party over a public network for a physical address associated with a logical address of a destination party;

database circuitry for determining a physical address associated with said request, where said logical address can be associated with more than one physical address, based on one or more current parameters.

22. The circuitry of claim 21 wherein one of said parameters comprises a time of day parameter.

23. The circuitry of claim 21 wherein one of said parameters comprises a day of week parameter.

24. The circuitry of claim 21 wherein one of said parameters comprises a day of week.

25. The circuitry of claim 21 wherein one of said parameters comprises a location associated with the calling party.

26. The circuitry of claim 21 wherein one of said parameters comprises a telephone number associated with the user.

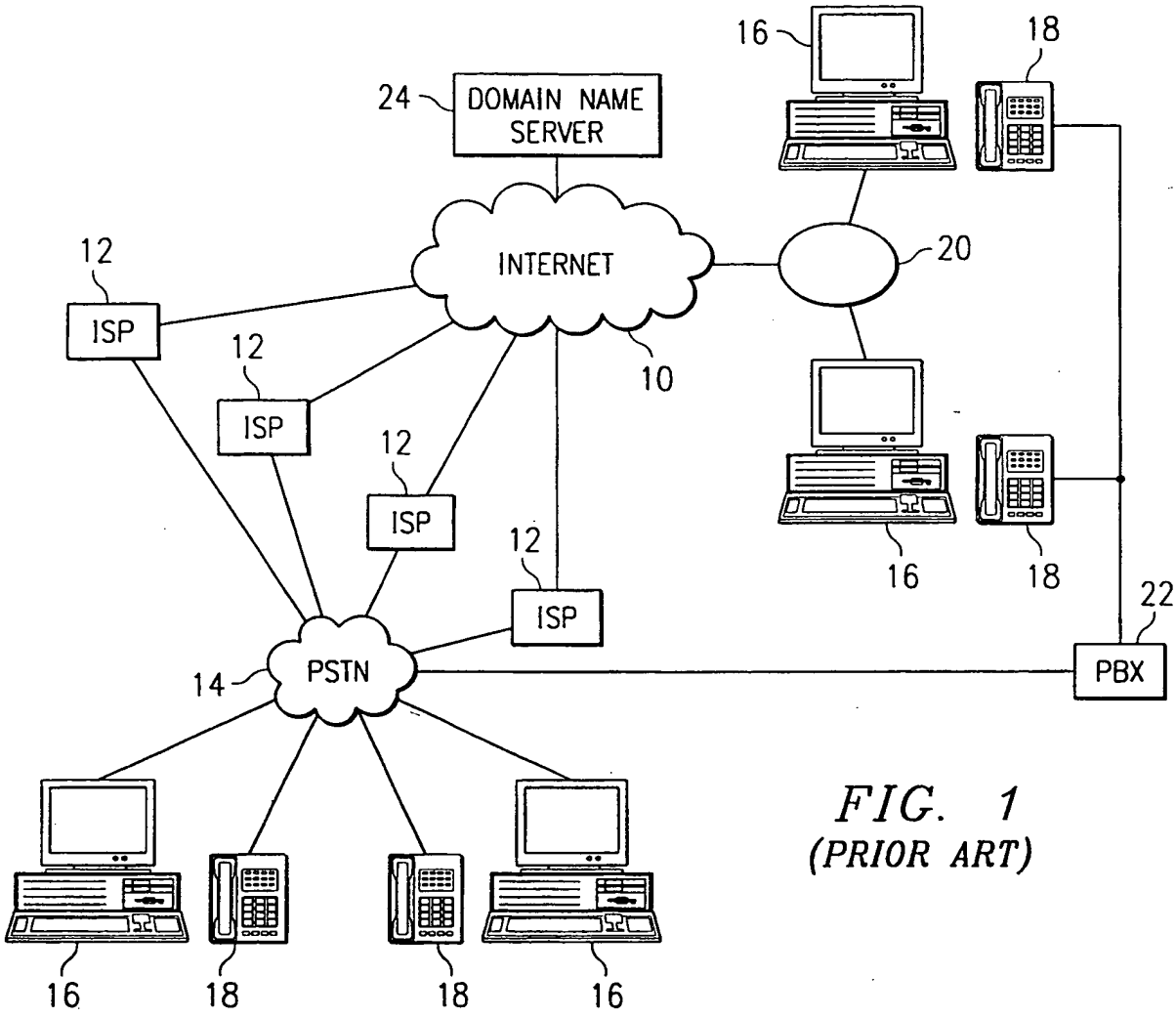


FIG. 1
(PRIOR ART)

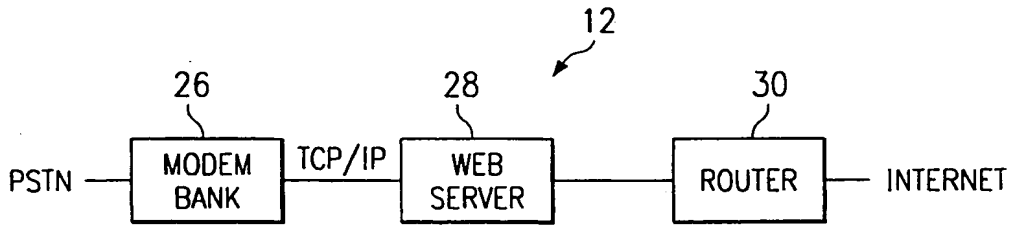


FIG. 2a
(PRIOR ART)

FIG. 5

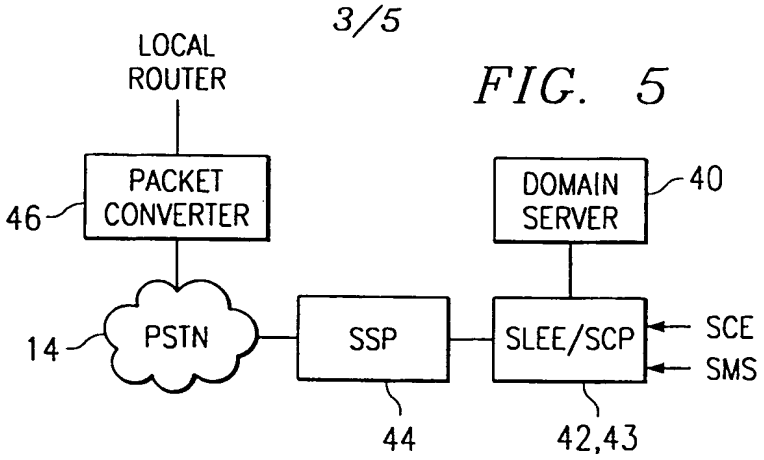


FIG. 6

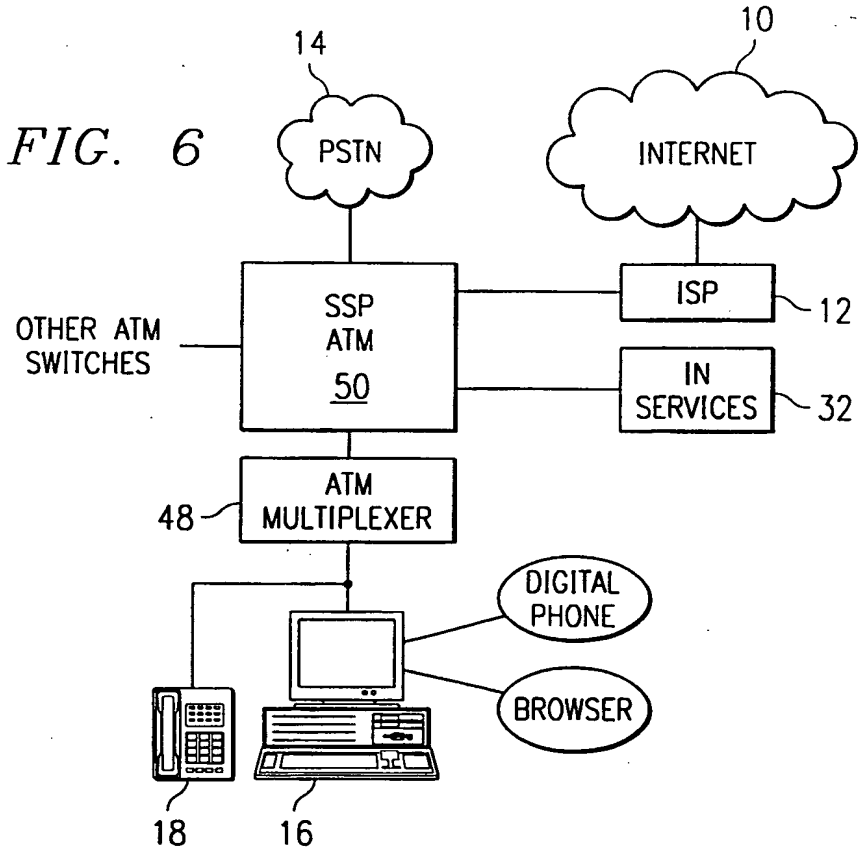


FIG. 7

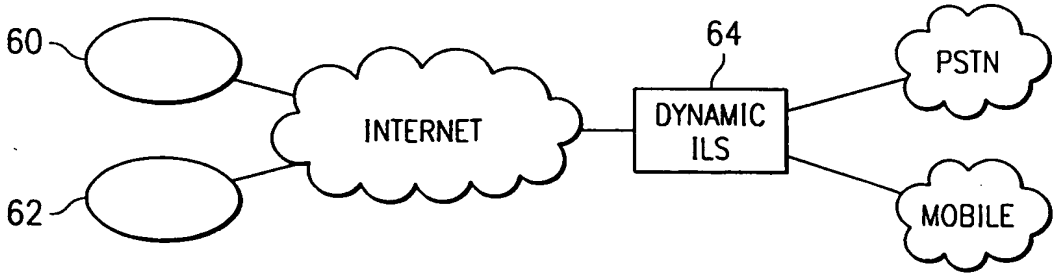
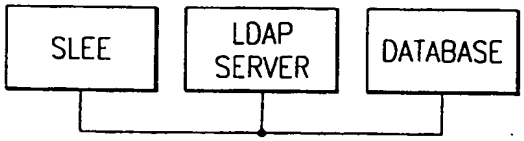


FIG. 9



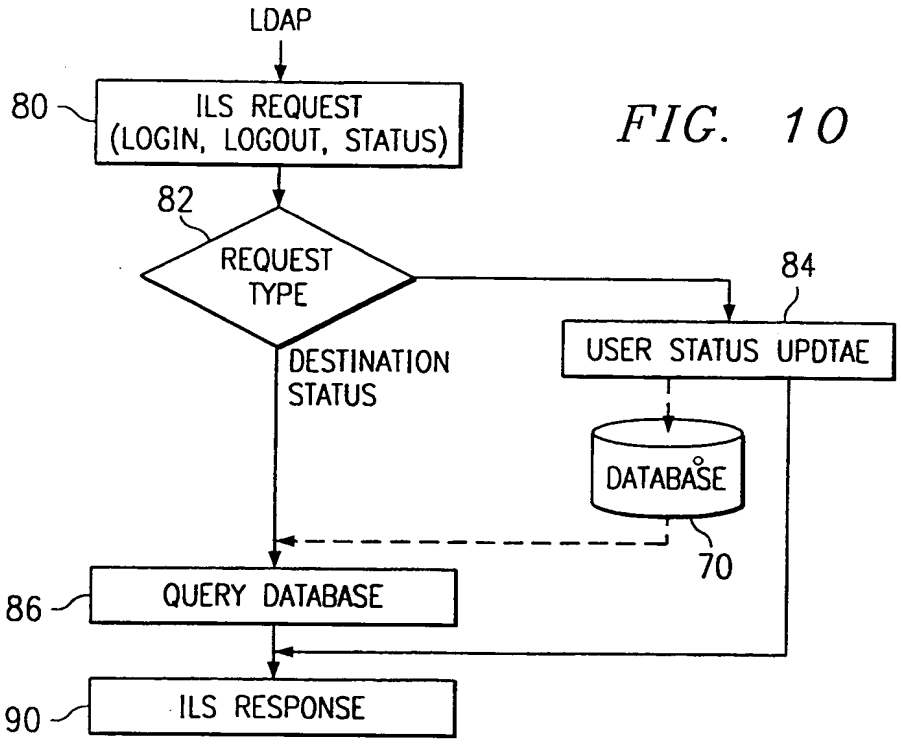


FIG. 10

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X P,A	EP 0 817 444 A (SUN MICROSYSTEMS INC) 7 January 1998 see abstract see column 2, line 20-39 see column 3, line 14-24 see column 4, line 47 - column 5, line 16 see column 5, line 49 - column 7, line 4 see column 7, line 30-44 see figure 3	1-7, 11-17 8-10, 18-20
A	WO 97 31490 A (LOW COLIN ;SEABORNE ANDREW FRANKLIN (GB); HEWLETT PACKARD CO (US)) 28 August 1997 see page 25, line 10-20 see page 26, line 17-21 see page 27, line 17-31 see page 35, line 19 - page 36, line 2 see page 36, line 19 - page 37, line 5 see page 44, line 30 - page 45, line 14 see claims 1,11 see figures 6,7,14	1-28